Technology Opportunity

Advanced Seal Design and Analysis Codes

The National Aeronautics and Space Administration (NASA) seeks to transfer seal design and analysis codes that can be used to reduce leakage flows and optimize seal life.

Potential Commercial Uses

- Reduce pollutants from rotating equipment such as pumps, turbines, and centrifugal compressors.
- Add damping to supercritical rotor systems
- Prevent oil leakage and coking in hot-end turbocharger bearing seals
- Gas turbine bearing compartment seals
- Turbine tip seals
- Pipeline compressors to prevent leakage of methane gas to the environment

Benefits

- Lower hardware costs
- Improved specific fuel consumption because of reduced leakage flows
- Industrial codes operate on a PC
- Reduced downtime for maintenance because seals can be optimized for long life

The Technology

Shaft seal design and analysis codes have been developed under a NASA contract for a multitude of seal types to help the turbomachinery designer select an appropriate seal and determine its leakage and dynamic performance. The industrial codes were developed for expeditious analysis, design, and optimization of turbomachinery seals. A scientific computational fluid dynamics (CFD) code, SCISEAL, capable of producing full three-dimensional flowfield information for a variety of cylindrical configurations was also developed. This code is used to enhance understanding of flow phenomena and mechanisms, to predict performance of complex situations, and to furnish accuracy standards for the industrial codes.

Industrial codes are separate, stand-alone codes that were integrated into a Knowledge-Based System (KBS). The KBS couples the industrial codes with a user-friendly graphical user interface (GUI). These codes were written for a PC environment using the OS/2 operating system. Both gas and liquid circumferential and face seals can be analyzed and

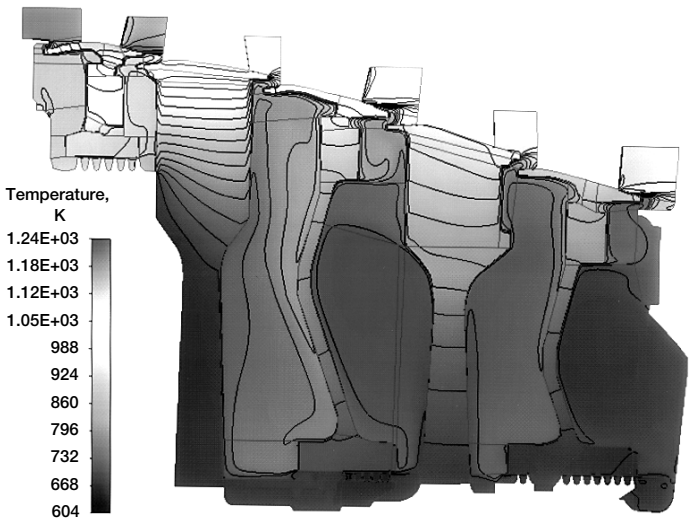

Figure 1.—CFD Research Corp. used SCISEAL to analyze secondary flows in the multiple connected cavities of the Allison T56 engine turbine to predict temperature contours.

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designed. Geometries such as steps, pockets, tapers, preloaded arcs, hydrostatic recesses, and spiral grooves can be treated. Labyrinth seals can also be analyzed and designed.

SCISEAL, the scientific code, was developed to provide detailed flow information about a variety of existing and new types of turbomachinery seals (see fig. 1). It is an advanced three-dimensional CFD code for solutions of the Navier-Stokes flow equations. SCISEAL has the unique capability to produce stiffness and damping coefficients that are necessary for rotordynamic computations.

Options for Commercialization

The best commercialization opportunity lies in selling lots of seals developed for a specific application. The codes were developed with public monies and are available for use. NASA Lewis Research Center tests advanced seal concepts for high temperature and cryogenic applications. Agreements could be made to test seals at NASA.

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